THE TYPE SPECIMENS OF SIPUNCULA AND ECHIURA DESCRIBED BY J. E. GRAY AND W. BAIRD

IN THE COLLECTIONS OF THE BRITISH MUSEUM (NATURAL HISTORY)

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THE TYPE SPECIMENS OF SIPUNCULA AND ECHIURA DESCRIBED BY J. E. GRAY AND W. BAIRD

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By MARY E. RICE & A. C. STEPHEN

SYNOPSIS

Type specimens of Sipuncula and Echiura of Gray (1828) and Baird (1868) in the collections of the British Museum (Natural History) were re-examined by the authors. Identifications were checked and, in most instances, the specimens were redescribed. Of the 23 type specimens, the specific names of the following were shown to be senior subjective synonyms of currently accepted names : *Siphunculus arcuatus* Gray 1828 [= *Phascolosoma lurco* (Selenka and de Man 1883)], *Phascolosoma perlucens* Baird 1868 [= *Phascolosoma dentigerum* (Selenka and de Man 1883)], *Themiste lageniformis* Baird 1868 [= *Themiste signifer* (Selenka and de Man 1883)], and *Aspidosiphon jukesii* Baird 1873 [= *Aspidosiphon corallicolus* Sluiter 1902]. Five were shown to have currently accepted valid names, one was a nomen dubium, and the remainder were junior synonyms to currently used names.

INTRODUCTION

During the course of the preparation of a monograph on the Sipuncula and Echiura, it became necessary to clarify the status of the several species described by Gray (1828) and Baird (1868 and 1873) since many were originally described mainly on external characters. Where these authors' specimens are still preserved in the collections of the British Museum (Natural History), it has been possible to check their identifications and, in most instances, to redescribe them. Because of the historic value of the specimens, only a minimum of dissection and manipulation was attempted ; hence complete redescriptions are not always provided in this report.

This study was initiated by the late A. C. Stephen of the Royal Scottish Museum and, after Dr. Stephen's death in 1966, it was completed by Mary E. Rice of the Smithsonian Institution.

Thanks are due to the Trustees, to Dr. J. P. Harding, Keeper of Zoology, and to Mr. R. W. Sims, Head of the Annelida Section, British Museum (Natural History) for permission to examine the specimens. Mrs. Carolyn Gast, scientific illustrator at the Smithsonian Institution, is gratefully acknowledged for her illustrations of the type specimens.

THE GRAY TYPES

Gray (1828 : 8, pl. 6, figs. 1, 4, 4a) described a series of sipunculans from the collections of the British Museum (Natural History) under the heading " Radiata ",

family Siphunculidae. He included six species, four of which were described as new. These were : *Siphunculus dentallii*, *Siphunculus tuberculatus*, *Siphunculus arcuatus*, and *Themiste hennahi*.

Gray's brief diagnoses were in Latin, followed by a few comments in English, and they pertained only to non-specific external characters. Consequently, even though Gray's type specimens remained extant in the British Museum (Natural History), they were ignored by most subsequent authors. A re-examination of the specimens shows that the species names of *S. arcuatus* and *T. hennahi* are valid, whereas *S. tuberculatus*, demonstrated by Baird (1868) to be a junior primary homonym and renamed by him as *Phascolosoma grayi*, is here synonymized with *Phascolosoma noduliferum* Stimpson 1855. Specimens of *S. dentalii* are missing from the collection and apparently lost.

Siphunculus arcuatus Gray, 1828

Siphunculus arcuatus Gray, 1828, p. 8.
Phascolosoma arcuatum : Baird, 1868, p. 88.

Holotype : Reg. No. 1965. 25. 2

Type locality : India. Coll. Hardwicke.

Description : The specimen was preserved in a curved position with the introvert entirely retracted. It is in good condition with most of the internal organs well preserved, possibly because an incision had been made at one time in the body wall. The trunk measures approximately 100 mm in length and 20 mm at its maximum width. The retracted introvert is slightly longer than the trunk and is coiled and twisted within the body cavity. The basic colouration of the trunk is pale brown, although in the anterior third of the trunk there is an area of reddish-brown pigmentation. The papillae, distributed over the entire trunk, stand out as dark brown spots against the lighter background ; they are largest and most concentrated at the anterior and posterior extremities of the trunk (Figure 3, 3a-3c). The anterior and posterior papillae are pyrimidal in shape, the largest measuring 0·8 mm in width and 0·5 mm in height in the posterior region ; the middle papillae are lower and more rounded, attaining a size of 0·5 mm in width and 0·24 mm in height. The platelets of the posterior and anterior papillae are dense and compact and in some cases more darkly pigmented toward the center of the papilla, whereas those of the middle papillae are more dispersed and evenly coloured (Figure 2). Surrounding the central opening of the papilla the platelets are smaller ; otherwise there is no obvious gradient in size of platelets.

The hooks are unidentate, strongly curved, with a clear central streak which is markedly wider at its basal extremity (Figure 2). The basal portion of the hook is diaphanous in nature and very much thinner than the remainder of the structure. Determination of the number of rows of hooks and number of tentacles would have required excessive manipulation of the retracted introvert of this historically valuable specimen ; hence, no observations were made on these characters. In distended areas of the body wall in the posterior half of the trunk, the cuticle is inflated into a series of small, thin-walled sacs (Figure 4). Upon dissection of the animal these sacs

appear to be vesicular expansions of the coelomic cavity into the body wall, extending through spaces between longitudinal and circular muscles. The integument covering the vesicles is markedly thinner than that of the remainder of the trunk.

Circular muscles, as well as longitudinal muscles, are divided into bundles. The longitudinal bundles show little anastomosis, numbering 18 at the level of the nephridiopores and 19 in the region of the posterior nephridia. The bundles of the circular muscles are smaller, more numerous, and less distinctive with frequent anastomoses. Two posterior retractor muscles originate in the posterior sixth of the trunk from longitudinal muscle bundles 2 and 3 and the two muscles soon join to form a single posterior retractor (Figure 1). The anterior retractors originate on either side of the ventral nerve cord, from longitudinal muscle bundle number 1 at the anterior end of the posterior quarter of the trunk near the level of the union of the posterior retractors. The anterior retractors soon join the posterior retractor to form a single retractor muscle (Figure 1).

The spindle muscle is attached at the posterior extremity of the trunk and after coursing anteriorly through the center of the intestinal coil and along the rectum, it attaches to the body wall immediately anteriorly to the anus. Prominent wing muscles fasten the anterior rectum to the body wall. Intestinal coils are numerous, but the exact number is difficult to ascertain because the coiling is somewhat erratic and parts of the gut are not well preserved.

The nephridia are approximately one-half as long as the trunk and are attached to the body wall for nearly their entire length. The nephridiopores open slightly anterior to the anus.

Remarks : Gray's holotype of *Siphunculus arcuatus* corresponds with descriptions of *Phascolosoma lurco* (Selenka and de Man 1883, p. 61–63) in the following significant taxonomic characters : structure of hooks on introvert, form and distribution of papillae, fusion of four retractors into a single, long retractor muscle, and the number of longitudinal muscles.

In *Phascolosoma lurco,* as in the holotype of *Siphunculus arcuatus,* the origin of the anterior retractor muscles is ventral to that of the posterior retractors rather than the more common arrangement for sipunculans in which the posterior muscles originate ventral to the anteriors. One exception for *Phascolosoma lurco* was found in specimens examined by Lanchester (1905) in which both pairs of retractors originated from the same longitudinal line. The point of fusion of the four retractors in *Phascolosoma lurco* has been described differently by various authors. Selenka's figure depicts a fusion of the left anterior and posterior retractor muscles and a separate fusion of the two right retractors, resulting in one left and one right retractor which, after a short distance, unite to form a single muscle. Both Lanchester (1905) and Edmonds (1956), on the other hand, report that the four muscles fuse at about the same level to form one long retractor muscle. *Siphunculus arcuatus* presents a further variation : the two posterior muscles fuse to form one central muscle which courses anteriorly for a short distance and is then joined on either side by the left and right anterior muscles.

In *Phascolosoma lurco* as in *Siphunculus arcuatus,* the circular musculature shows a propensity for separation into bundles, although the bundles are not as widely spaced

nor as prominent or regular as those of the longitudinal muscles (Edmonds 1956, Selenka, de Man and Bülow 1883). In his description of *Phascolosoma lurco*, Selenka mentions small inflated areas in the body wall which may be comparable to the coelomic vesicles found in Gray's holotype.

In a synonymy of the two names, the specific name *arcuatus* has priority over *lurco*.

Siphunculus dentalii Gray, 1828

Siphunculus dentalii Gray 1828, p. 8 ; Johnston, 1833, p. 233–235, fig. 25.

Type locality : Coast of Yorkshire, in *Dentalium*. Coll. Clift.

This specimen is missing from the collection. It was not illustrated in Gray's report and his description which lists only general external characters is inadequate for a determination of the species involved. The locality of the specimen and its habitat in the shell of a *Dentalium*, suggest that it may have been *Phascolion strombus* (Montagu). However, Gray also described and figured a specimen of *Phascolion strombus* which he designated as *Siphunculus strombus* Mont. ; thus, it is obvious that he did not consider the two specimens to be the same, although the differences in his descriptions are non-specific, related mainly to shape and size of trunk and introvert.

In 1833, Johnston figured *S. dentalii* and elaborated on Gray's description, but he does not indicate whether he examined Gray's type specimen. Later authors (Selenka, de Man, and Bülow 1883, Gerould 1913, tenBroeke 1929) have placed *S. dentalii* Gray in synonymy with *Phascolion strombus* (Montagu).

Siphunculus tuberculatus Gray, 1828

Siphunculus tuberculatus Gray, 1828, p. 8 (non *Siphunculus tuberculatus* de Blainville, 1827). *Phascolosoma grayi* (nom. nov.) Baird, 1868, p. 88.

Holotype : Reg. No. 1965.25.4

Type Locality : Unknown

Gray (1828) described this specimen, to which he gave the name *Siphunculus tuberculatus*, as follows : " The body is conical and attenuated behind ; the trunk tubercular at the base, and nearly smooth at the apex. Length of the body 1½ inch, its breadth ¼ inch ; length of the trunk ½ inch ". In 1868 Baird pointed out that the specific name *tuberculatus* had been preoccupied by de Blainville in 1827. On re-examining Gray's specimen he concluded that it was different from de Blainville's species and renamed it *Phascolosoma grayi*, after Gray, who first defined the species. The type is now in rather poor condition. It had been previously dissected and most of the internal organs have been lost.

Description : The length of the body with fully extended introvert is approximately 60 mm, the maximum width 5 mm. The length of the introvert is slightly less than that of the trunk. The overall colour is a pale greyish yellow, somewhat darker at the base of the introvert and posterior end. The base of the introvert, the preanal region and the posterior quarter of the trunk are marked by a dense

accumulation of prominent, rounded, dome shaped papillae (Figure 11), the largest of which measures approximately 0·32 mm in diameter and 0·28 mm in height. In the middle region of the trunk the papillae are smaller, measuring as much as 0·20 mm in diameter and 0·08 mm high, and although distributed in a regular pattern they are more widely separated than at the extremities of the trunk. Platelets are arranged in a distinctive pattern in all papillae : a ring of dark brown platelets surrounds a clear central area and light-colored widely spaced platelets cover the remainder of the papilla (Figure 10). Roughly 20 rows of dark brown hooks encircle the anterior quarter of the introvert followed by numerous irregularly placed hooks. Simple in structure, the hooks are bent terminally and show a single clear central streak (Figure 9). Tentacles, although retracted, had been exposed by a previous dissection and 12 long filiform processes were counted.

The skin of the middle trunk is characterized by transverse wrinkling. Longitudinal wrinkling, weak and irregular in the middle trunk, is more pronounced in preanal and posterior regions.

Internally only the rectum, nerve cord, and nephridia remain in this incompletely preserved specimen. The nephridiopores and anus open at the same level. A broad wing muscle attaches the rectum to the body wall and the spindle muscle runs along the length of the rectum, inserting on the body wall immediately anterior to the anus. Only one nephridium, the left, is intact and it is attached for most of its length to the body wall with only the posterior end free. The longitudinal musculature is arranged in bundles which undergo considerable anastomosis, but at the level of the nephridiopores 25 bundles can be counted. The retractor muscles have been broken off and only remnants remain attached in the anterior introvert.

Remarks : The characters which are still recognizable in this incomplete specimen agree closely with those of *Phascolosoma noduliferum* Stimpson 1855, as enumerated in a recent review of the species by Edmonds (1956). The number of muscle bundles falls within the range for *P. noduliferum* and the structure and distribution of the distinctive hooks and papillae are identical.

Although Baird listed *Phascolosoma noduliferum* in his monograph (1868), he failed to recognize the similarities between this species and the specimen designated by Gray as *Siphunculus tuberculatus*. Hence, after indicating that Gray's name was pre-occupied, Baird provided a new name, *Phascolosoma grayi*, whereas it appears that he should have synonymized the junior homonym with *P. noduliferum* Stimpson.

Themiste hennahi Gray, 1828

Themiste hennahi Gray, 1828, p. 8 ; Baird, 1868, p. 98 ; Stephen, 1964, p. 458 ; Amor, in press.

Lectotype : Reg. No. 1965.16.1.

Paralectotypes : Reg. No. 1965.16.2/5

Type locality : Peru. Coll. Rev. Hennah.

Stephen (1964), in a reclassification of the Sipuncula, demonstrated that the name *Themiste* Gray, 1828, was the senior synonym of the genus *Dendrostomum* Grube, 1858. Gray figured the tentacular crown of *Themiste hennahi*, the type species of *Themiste*

by monotypy, and clearly showed the dendritic nature of the tentacles but this paper was overlooked by Grube who erected the genus *Dendrostomum* for species with dendritic tentacles. Gray's original description of *Themiste hennahi*, quoted in full by Stephen as it had been printed in a thinly distributed publication of which few copies survive, was brief and inadequate by modern standards ; hence, a complete redescription of the specimens to which Gray gave the name *Themiste hennahi* is presented here. From the five specimens still intact at the British Museum (Natural History), Stephen (1964) designated one lectotype and four paralectotypes.

Description : The lectotype designated by Stephen (1964) is a fully extended specimen, measuring 70 mm in length to the base of the tentacles with a maximum width of approximately 15 mm (Figure 8). The introvert is one-fifth the length of the body and it is characterized by a relatively short smooth zone (5 mm) adjacent to the tentacular crown. The cuticle of the posterior introvert has become detached from the underlying epidermis, exposing the protruding canals of the epidermal glands (Figure 8a), and forming a wrinkled mass at the base of the introvert. No hooks or spines are apparent on the introvert. The predominant colour of the body is a pale grey, whereas that of the tentacles and smooth zone is light tan.

The well-extended dendritic tentacles arise from six primary stems (Figure 7). Between the bases of the tentacular stems are the six lappets or lips, membranous crescentic folds which form the margin of the mouth and demarcate the proximal boundaries of the six primary food grooves leading into the mouth from the tentacular stems. The dorsal lappet is distinguished by its large size and its proximity to the nuchal organ. The tentacular crown is asymmetric, the lateral tentacles exceeding both the dorsals and ventrals in length. The primary food grooves of the lateral stems are also longer, bifurcating at a greater distance from the mouth than the ventral and dorsal grooves.

The openings of the epidermal glands are distributed in a regular pattern over the surface of the trunk ; in the anal region the openings are in the form of slits and are situated on oblong elevations of the skin (Figure 8b). More posteriorly the openings approach a spherical shape ; in the middle of the trunk they are situated between transverse furrows of the skin, but no distinctive elevations are apparent (Figure 8c). In the posterior portion of the trunk the skin is marked by longitudinal as well as transverse furrows, resulting in small irregular rectangles within each of which is enclosed a gland opening. At the posterior extremity of the body the openings are elevated on dome-shaped swellings of the skin (Figure 8d). The position of the nephridiopores is slightly posteriorly to that of the anus.

Since the lectotype had not been dissected, it was left intact and the internal anatomy of this specimen was not studied. However, of the four paralectotypes, two had been previously dissected and the better preserved and more clearly dissected specimen was selected for the description of internal anatomy which follows (Figure 6). The introvert of this paralectotype was retracted and the length of the body without introvert was approximately 37 mm.

The musculature of the body wall is smooth and iridescent. A pair of wide, thickened retractor muscles originate on either side of the ventral nerve cord at the beginning of the posterior third of the trunk. The spindle muscle is not attached

posteriorly, but emerges anteriorly from the intestinal coil and, after giving off a short branch to the caecum, continues along the rectum, attaching to the body wall slightly posteriorly to the level of the anus. Three fixing muscles were observed (Figure 6). F_1 arises on the left side of the body in the anterior third of the trunk in a ventrolateral position and inserts on the œsophagus in the region where the contractile vessel breaks up into many blind vessels. The F_2 unfortunately had been broken in this specimen and its point of insertion was not determined ; its origin is in a ventrolateral position on the left side of the body slightly posteriorly to the origin of F_1. The fixing muscle F_3 is a short thick muscle which attaches the last ascending intestinal coil to the dorsal body wall.

The oesophagus is long, narrow, and thin-walled and, in this specimen it is looped under the right retractor (Figure 6). Running along the dorsal side of the œsophagus is the contractile vessel, enormously distended anteriorly. It is attached to the œsophagus for approximately one-fifth the length of the latter and at its posterior end it breaks up into many blind vessels or villi which ramify throughout the body cavity. Resembling strings of beads, these processes of the contractile vessel are marked by globular enlargements connected by thin, narrow, sometimes coiled strands. The intestine is wound into numerous coils (approximately 40 single coils), difficult to count with accuracy because of irregular winding and poor preservation in some parts. The wall of the gut is very thin and the ascending gut is filled with fine sand or mud particles. The beginning of the rectum is marked by the presence of a small caecum and in the anal region the rectum is attached to the body wall by broad wing muscles.

Two nephridia, more than half the length of the trunk, hang freely in the body cavity. The anterior portions of the nephridia are swollen and distended ; the nephrostomes are small and simple. Nephridiopores open slightly posteriorly to the anus.

In addition to the lectotype and paralectotype described above, there are three remaining paralectotypes of *Themiste hennahi*. One of these is a small specimen which had been dissected ; its tentacles are partially extended and the trunk, without the introvert, measures approximately 20 mm in length. In the other two paralectotypes the introvert is retracted and the approximate measurements of the lengths of the trunks are 45 mm and 40 mm.

Remarks : The number of tentacle stems was recorded originally as five (Gray 1828). Stephen (1964), looking at the same specimen which he designated as the lectotype, reported Gray's count of tentacles to be in error, stating that " . . . there are only four tentacle stems, one shows a false dichotomy which misled Gray into thinking that there were five ". A re-examination of this specimen by one of the present authors (Rice) has shown, in contradiction to the two previous reports, that there are six tentacular stems with six distinctive primary food grooves. The oral view of the tentacular crown illustrated in Figure 7 clearly shows the six primary stems, food grooves and lips. Gray figured a lateral view of the anterior end of this same specimen, but his view does not clearly delineate the number of tentacles. Perhaps the past discrepancy has been due in part to a failure to regard the number and position of lips. Moreover, the variation in length, size, and branching of the

tentacles and the differing lengths of the primary food grooves of the specimen prove to be confusing in any attempt to count tentacles. Another possible source of error in the interpretation of tentacular arrangement is the absence of one of the tentacles from the right ventral tentacular stem ; apparently it had been broken off at some time just beyond the point of the first bifurcation of the primary stem, and only the base of the tentacle and the beginning of the secondary food groove remain (Figure 7).

The two species *Dendrostomum peruvianum* Collin, 1892, and *Themiste hennahi* Gray were synonymized by Stephen in 1964. *D. peruvianum* has been recorded in the literature by two authors in addition to Collin (1892) : Fischer (1914) and Wesenberg-Lund (1955). As in the case of *T. hennahi*, reports of the number of tentacles of *D. peruvianum* are found to vary. Fischer (1914) reported five tentacle stems, whereas in the original description of the species Collin mentioned only four.

Collin (1892) described slightly raised papillae in the middle and posterior body of *Dendrostomum peruvianum* ; Fischer denied the presence of typical papillae, but nevertheless described dome-shaped elevations in the posterior body onto which the canals of the skin glands opened. Wesenberg-Lund (1955) reported an absence of projecting papillae, but described instead low circular papillae lying between the wrinkles of skin. In the Gray lectotype projecting papillae were not found in the middle of the trunk but in the posterior and anal regions the glands opened on elevated protuberances of the skin.

Œsophageal protuberances described by Collin were not seen by Wesenberg-Lund on the specimen which she identified as *Dendrostomum peruvianum*, nor were they observed in this study on the Gray paralectotype. As in Fischer's specimen of *D. peruvianum*, the caecum of the paralectotype of *T. hennahi* is found at the beginning of the rectum, not on the penultimate intestinal coil as described by Collin. Also varying from Collin's description, the F_3 fixing muscle of the paralectotype is attached to the last intestinal coil rather than the penultimate, and an F_4 fixing muscle is absent.

In other characters, published descriptions of *Dendrostomum peruvianum* agree essentially with the Gray specimens. The beaded structure of the villi of the contractile vessel, clearly evident in the Gray paralectotype, is described as characteristic of *D. peruvianum*.

Themiste hennahi also shows many similarities to the species described as *Dendrostomum zostericolum* Chamberlin 1919 and *Dendrostomum schmitti* Fisher 1952. The possibility that these may all represent a single species remains to be determined by future studies.

THE BAIRD TYPES

In 1868 Baird published his monograph on the species of worms belonging to the subclass Gephyrea in the collections of the British Museum. In this he listed 142 species, including 18 descriptions of new species, 17 of which were sipunculans and one a priapulid. Later in a short paper published in 1873, he erected two additional species, *Aspidosiphon jukesii* and *Echiurus farcimen*. Baird's descriptions were short and based solely on external characters ; thus, they were inadequate for recognition

by later workers. In Appendix E of their monograph, Selenka, de Man and Bülow listed all of the new species described in 1868 by Baird with the exception of *Pseudoaspidosiphon gracile* which they considered in the text. They examined six of Baird's type specimens, redescribing and retaining the names of four, and placing two other names in synonymy. The remainder listed in the appendix they considered to be insufficiently described and for some reason which remains unexplained they did not examine these specimens. No further attention seems to have been given to the specimens until Edmonds (1955, 1961), reporting on the sipunculans of Australia, redescribed three of Baird's types.

For this report, all of Baird's type specimens have been re-examined, the validity of the names is reviewed, and, where appropriate, they are relegated to the proper synonymy.

Sipunculus aeneus Baird, 1868

Sipunculus aeneus Baird, 1868, p. 81.
Siphonosoma australe : Edmonds, 1961, pp. 217–220, 2 figs.

Holotype : Reg. No. 1952 : 10.8.

Type locality : New Zealand. Coll. Cuming.

This specimen was examined by Edmonds (1961) who redescribed it completely and referred it to *Siphonosoma australe* (Keferstein 1865). Following Baird's original description and previous to Edmonds' report, the name had appeared in the literature only twice : Selenka, de Man, and Bülow (1883) listed it in Appendix E of their monograph and Benham (1903) referred to it as a " species inquirenda ".

Sipunculus angasii Baird, 1868

Sipunculus angasii Baird, 1868, p. 80, pl. IX, fig. 1.
Sipunculus angasi : Edmonds, 1955, pp. 83–86, figs. 1–4.

Syntypes : Reg. No. 1864 : 12.13.3a/b.

Type locality : Port Lincoln, Spencer Gulf, South Australia. Coll. Angas.

In his description, Baird (1868) mentioned only non-specific external characters and the name was not used again in the literature until 1955 when Edmonds identified a large number of specimens from Australia as *Sipunculus angasi*. At that time Edmonds re-examined Baird's syntypes which he considered to be juveniles and described the internal anatomy of one of the specimens. *Sipunculus angasi* was regarded by Edmonds as closely allied to *S. robustus* Keferstein and *S. nudus* Linnaeus.

Sipunculus deformis Baird, 1868

Sipunculus deformis Baird, 1868, p. 80–81, pl. ix, fig. 2.
Siphonosoma cumanense : Edmonds, 1955, p. 90–92.

Holotype : Reg. No. 1965.25.7.

Type locality : Sir Charles Hardy's Island, North Australia. Coll. Brookes.

Edmonds in 1955 gave a brief description of the internal anatomy of this specimen and considered it to be *Siphonosoma cumanense*. The only other time the name

Sipunculus deformis has appeared in the literature subsequent to Baird's description was in Appendix E of the monograph by Selenka, de Man and Bülow (1883).

Sipunculus eximinoclathratus Baird, 1868

Sipunculus eximio-clathratus Baird, 1868, pp. 81–82.

HOLOTYPE : Reg. No. 1965.25.8.

TYPE LOCALITY : Philippine Islands. Coll. Cuming.

Baird's description was limited to external characters and he did not dissect the specimen. It is still in good condition, although a small part of the body wall had been damaged and the viscera at this point destroyed. A dissection was made by one of the authors (ACS) and a description of the internal anatomy is included below.

The specimen was preserved in a curved position with most of the introvert retracted. Measuring approximately 70 mm in length, the trunk is contracted in the mid-region but distended into bulbous expansions anteriorly and posteriorly. As pointed out by Baird, the skin is divided into rectangular areas by longitudinal and transverse furrows and the introvert is covered with triangular protuberances which point in a posterior direction.

Thirty-three longitudinal muscle bundles were counted in the anterior fifth of the trunk and about 30 in the middle. Four short retractor muscles originate quarter of the length of the trunk from the anterior end. The spindle muscle attaches to the body wall anterior to the anus ; a short distance posterior to the anus the characteristic " Buschel " organs occur. A caecum is present at the beginning of the rectum. The frons, or cerebral organ, is a simple flap of tissue with no obvious elaborations.

These characters correspond with those of *Sipunculus nudus* Linnaeus, a widely distributed tropical form.

Phascolosoma aethiops Baird, 1868

Phascolosoma aethiops Baird, 1868, p. 90.

HOLOTYPE : Reg. No. 1839.12.26.46.

TYPE LOCALITY : St. Vincent, West Indies. Coll. Guilding (?).

In the monograph of Selenka, de Man, and Bülow (1883) the name *Phascolosoma aethiops* is listed in Appendix E and followed by the question " Ist ein Dendrostoma? ". Since there is no reason to believe that Selenka ever examined this specimen, it is probable that his question arises from Baird's description of the tentacles as " short and numerous " and his mistaken reference to " small black spines " on the introvert (Baird 1868).

DESCRIPTION : The holotype is in rather fragile condition and seems to have been either wholly or partially desiccated at some time. It was dissected by one of the present authors (ACS) and even with a minimum of interference the tentacular crown became detached.

The stout, thick trunk is 25 mm long and 8 mm at its maximum width ; the introvert is 5 mm in length without the tentacles. The tentacles are filiform, numerous,

and in a position dorsal to the mouth. Even though the tentacles were described by Baird as short, they measure as much as 3 mm in length which is a considerably greater relative length than that found in the majority of species of *Phascolosoma.*

The light brown skin is covered with numerous contrasting dark brown papillae. On the introvert the papillae are conical, resembling spines, although true spines, as cited by Baird, are lacking. Papillae on the trunk are subcircular and are largest and most numerous on the anterior and posterior extremities. Contrary to the situation in most species of this genus, the largest papillae are located ventrally rather than dorsally. Each papilla is characterized by distinctive dark brown platelets which are evenly dispersed around a clear central area. Individual platelets are also scattered over the cuticle among the papillae.

The longitudinal muscle bundles show considerable anastomosis ; immediately anteriad to the origin of the retractors they number approximately 20. Four retractor muscles originate at nearly the same level in the middle third of the trunk, although the dorsals are slightly anterior to and somewhat thinner than the ventrals. The dorsal and ventral retractors soon join to form left and right retractors which remain separated for most of their length.

The gut is attached posteriorly by a spindle muscle and is comprised of approximately 25 single coils. A single fixing muscle extends from an attachment to the body wall left of the ventral nerve cord in the mid-region of the body to the intestinal coil. Strong wing muscles attach the rectum to the body wall in the region of the anus. A prominent contractile vessel with numerous villi runs along the œsophagus and continues into the beginning of the intestinal coil.

Part of the left nephridium is missing, but the right nephridium is three-quarters of the length of the trunk and is attached to the body wall for two-thirds of its length.

Remarks : This specimen is identical to *Phascolosoma antillarum* Grube and Oersted 1859 as evidenced by similarities in the form and distribution of papillae and platelets, tentacular form and pattern, structure of contractile vessel and villi, relative length and attachment of nephridia, the number of longitudinal muscle bundles and the attachment and union of retractor muscles.

Phascolosoma albolineatum Baird, 1868

Phascolosoma albolineatum Baird, 1868, p. 91–92.
Phymosoma albolineatum : Selenka and de Man, 1883, pp. 71–72, pl. ix, fig. 128–129.

Holotype : Reg. No. 1925.25.1.

Type locality : Philippine Islands. Coll. Cuming.

The holotype is still in fairly good condition and had been dissected previously. It is presumed to be the specimen described and figured by Selenka, de Man and Bülow (1883), since they state that their description is based on Baird's original specimen. They described it fully and the species remains valid.

Phascolosoma capsiforme Baird, 1868

Phascolosoma capsiforme Baird, 1868, p. 83–84, pl. ix, fig. 3 ; Selenka, de Man, and Bülow, 1883, p. 27–28, pl. iv, figs. 38–39.

Syntypes : Reg. No. 1842.2.24.60/63.

Type locality : Falkland Islands. Coll. W. Wright.

One of Baird's specimens was examined by Selenka, de Man, and Bülow who gave it a full description, including an account of the internal anatomy and figures of the papillae. Since none of the four syntypes in the Museum had been dissected, it must be presumed that the specimen described by Selenka was not returned or has been lost. The four remaining specimens are in excellent condition. One is partially expanded ; the others are contracted.

The characters, as reported by Selenka (1883), agree with those of *Golfingia margaritacea* Sars, a common species of northern seas and now recorded from a number of localities in the Antarctic. Selenka, de Man, and Bülow noted the close resemblance between the two species, and several authors have since called it a subspecies of the northern species (Fischer 1896, 1913, Benham 1922, Edmonds 1965). In a description of species from the Ross Sea, Edmonds (1965) reviewed previous reports of the northern and southern forms and concluded that the southern species is properly designated as *Golfingia margaritacea capsiformis* (Baird).

Phascolosoma fasciatum Baird, 1868

Phascolosoma fasciatum Baird, 1868, p. 89.

Syntypes : Reg. No. 1849.8.4.18/19.

Type locality : Madiera (Azores). Coll. N. Lister.

The two syntypes are in good condition and neither has been dissected previously. Baird (1868) characterized the species by the brown bands on the introvert, the reddish brown spots on the body and the many small reddish papillae of similar size anteriorly and posteriorly. From Baird's description, Selenka, de Man, and Bülow suggest in their Appendix E that *Phascolosoma fasciatum* Baird may be the same as *Phascolosoma granulatum* (Leuckart) 1828.

Description : In both syntypes the introvert is partially retracted ; the trunk of one specimen measures 30 mm in length with a maximum width of 5 mm and that of the other is 20 mm long with a maximum width of approximately 4 mm. The exposed portion of the introverts of the two specimens are marked by dorsal reddish brown bands and pale, inconspicuous papillae, becoming larger and more numerous toward the base of the introvert. In the anal region the papillae are variable in size and shape, the larger ones being pyrimidal and the others flat and low. The papillae of the middle trunk are smaller and rounded, whereas those of the posterior trunk are comparable in size and shape to the anal papillae.

The smaller syntype was dissected (by ACS) and an incision was made in the anterior introvert for a study of the hooks and small papillae lying between the hooks. The hooks, measuring approximately 0·072 mm at the base and 0·074 mm high, are

characterized by a well-developed central clear streak which shows no basal expansion and a marked terminal curvature with a secondary tooth (Figure 17).

The longitudinal muscle bundles in the dissected syntype number 22 immediately anterior to the origin of the dorsal retractors and show little anastomosis. A pair of ventral retractor muscles originates in the posterior third of the trunk and a pair of dorsal retractors in the middle third. The roots of the ventrals span muscle bundles 2 to 8 and the dorsals 5 to 8.

A fixing muscle arises left of the ventral nerve cord anteriad to the origin of the dorsal retractors and divides into two branches, one attaching to the rectum and one to the first descending intestinal coil.

The nephridia open at the level of the anus and extend posteriorly to the origin of the dorsal retractors. They are attached for approximately a half of their length.

Remarks : The characters as observed in this examination of the syntypes lend support to Selenka's suggestion that *Phascolosoma fasciatum* Baird 1868 is identical with *Phascolosoma granulatum* (Leuckart) 1828. The internal anatomy is essentially the same as described by Selenka for *P. granulatum* and the small papillae of the introvert (Figure 16) and the hooks (Figure 17) correspond in structure to those figured by Selenka for *P. granulatum* (Selenka, de Man, and Bülow, 1883, Pl. x, Figures 147–149).

Phascolosoma jeffreysii Baird, 1868

Phascolosoma jeffreysii Baird, 1968, p. 88–89.

Holotype : Reg. No. 1863.12.4.8.

Type locality : Spezzia. Coll. J. G. Jeffreys.

Baird (1868) defined the species on the basis of its shape, the red markings on the dorsal body, transverse striations, density of papillae on posterior and anterior trunk, sparsity of papillae on introvert, and the dorsal reddish brown rings of the introvert. His reasons for distinguishing *Phascolosoma jeffreysii* as a species separate from *P. fasciatum* are not clear. The following description includes internal anatomy and is intended to supplement Baird's report.

Description : The body length of the holotype is 40 mm with approximately 10 mm of the introvert exposed and the remainder retracted. Papillae at the base of the introvert are pyrimidal in shape and reddish-brown in colour ; at the posterior extremity many are similar, but others are rounded and colourless. Papillae over the rest of the body are mostly smaller, flat, and colourless. Hooks on the retracted introvert possess an accessory tooth and a clear central streak with little basal expansion (Figure 19). They measure approximately 0·054 mm at their base and 0·049 mm in height.

The holotype was dissected by one of the present authors (ACS). The longitudinal musculature is divided into 20 bundles in the region of the origin of the ventral retractors. The ventral retractors originate in the posterior third of the body ; the root of the left ventral retractor spans bundles 2–6 and the right 2–7. The dorsal

retractor muscles originate more anteriorly in the middle third of the trunk and their roots span bundles 4–7. A fixing muscle with two branches attaches to the rectum and to the first descending coil of the gut. The spindle muscle attaches posteriorly to the body wall and anteriorly it attaches immediately in front of the anus. Two nephridia open at the level of the anus and are attached to the body wall for two-thirds of their length. They extend posteriorly to the origin of the ventral retractor muscles.

Remarks : This specimen exhibits striking similarities to the syntypes of *Phascolosoma fasciatum* Baird and, like them, to descriptions of *P. granulatum* (Leuckart) in the shape and distribution of papillae, pigment markings on the trunk and introvert, and internal anatomy. The hooks are similar in structure to those of *P. fasciatum* (Figures 19, 17), except that the size and relative proportions vary and the clear area on the concave side is more distinct. Without seeing the specimen Selenka, de Man, and Bülow (1883) suggested that *P. jeffreysii* Baird 1868 might be the same as *P. granulatum* (Leuckart) 1828.

Phascolosoma lordi Baird, 1868

Phascolosoma lordi Baird, 1868, p. 92–93.

Holotype : Reg. No. 1860.3.21.75.

Type locality : Esquimalt Harbour, Vancouver Island. Coll. J. K. Lord.

Baird (1868) suggested that this specimen, found in the same locality as two specimens which he identified as *P. agassizii*, might be a variety of the latter. He distinguished *P. lordi* as a separate species on the basis of differences in " general appearance, size, and colour ". In Appendix E of their monograph, Selenka, de Man, and Bülow (1883) stated that *P. lordi* Baird seemed to be a variety of *P. agassizii* Keferstein. Fisher (1952) in his treatise on " Sipunculid Worms of California and Baja California " gave an exhaustive account of *P. agassizii* and included *P. lordi* in the synonymy.

Internal anatomy of Baird's holotype, not heretofore reported, is similar to *Phascolosoma agassizii*. Longitudinal muscle bundles exhibit a high degree of anastomosis ; 20 bundles were counted between the origins of the ventral and dorsal retractor muscles. The ventral and dorsal retractors originate in the posterior third of the trunk, the dorsals slightly anterior to the ventrals, and the muscles on each side soon fuse to form two muscles which continue separately to their union in the anterior introvert. A spindle muscle attaches to the posterior extremity of the trunk and anteriorly it adheres along the length of the rectum, attaching to the body wall immediately anterior to the anus. One fixing muscle is present, but accurate observations of its attachments were precluded by the fragile condition of the gut.

A hook from the anterior introvert of the holotype is illustrated (Figure 18). A comparison with Fisher's (1952) illustrations of hooks of *P. agassizii* shows similarities to most of the latter in the lack of a secondary tooth, the course and relative width of the central clear streak, and the basal triangular clear streak on the convex side.

Phascolosoma nigriceps Baird, 1868

Phascolosoma nigriceps Baird, 1868, p. 90, pl. xi, figs. 1, 1a.
Phymosoma antillarum : Selenka, de Man, and Bülow, 1883, p. 58.

Syntypes : Reg. No. 1859.12.7.63 a/b.

Type Locality : St. Thomas, West Indies. Coll. Cuming (?).

Baird lists specimens from St. Thomas, Jamaica, and Chile. Two specimens from St. Thomas are now present in the collections at the British Museum as syntypes and neither of these had been dissected. Selenka, de Man, and Bülow report that they examined Baird's original specimen from Chile, and it seems that this was not returned. These authors referred Baird's specimen to *Phascolosoma antillarum* Grube and Oersted 1858.

The two syntypes from St. Thomas, both with retracted introverts, measure 25 mm in length with a maximum width of 7 mm and 45 mm long with a maximum width of 10 mm. Prominent papillae, typically low and flattened with dark brown platelets of similar size, cover the trunk and are largest and most numerous in the anal region. In the larger specimen the posterior papillae are similar to those of the anal region, whereas in the smaller specimen the posterior cuticle is white and thin with only a few small papillae. In both specimens the platelets are scattered over the cuticle among the papillae.

The smaller specimen was dissected (by MER). The longitudinal musculature is divided into anastomosing bundles which number approximately 25 immediately posterior to the origin of the retractor muscles. The 4 retractor muscles originate at nearly the same level at the beginning of the posterior third of the trunk. A fixing muscle attaches on the rectum, anterior to a prominent caecum. The rectum is long and the intestine is comprised of approximately 22 single coils. A well-developed contractile vessel with numerous branched villi extends along the œsophagus into the first intestinal coil. The nephridia are attached to the body wall except for the posterior extremity and reach posteriorly to a level slightly below the origin of the retractor muscles.

The characters reported above correspond to those of *Phascolosoma antillarum* Grube and Oersted 1858 and thus give supporting evidence for Selenka's synonymy of *P. nigriceps* Baird 1868.

Phascolosoma perlucens Baird, 1868

Phascolosoma perlucens Baird, 1868, p. 90–91, pl. x, figs. 2, 2a
Phymosoma varians : Selenka, de Man and Bülow, 1883, p. 70

Syntypes : Reg. No. 1847.12.30.11.

Type locality : Jamaica, from holes in coral rocks. Coll. Grosse.

Of the three extant syntypes, one was figured by Baird in two illustrations of the entire animal showing external form and size. Selenka, de Man, and Bülow (1883, p. 70) list *Phascolosoma perlucens* Baird in a synonymy of *Phascolosoma varians*

Keferstein, with the explanatory statement " Die von uns vorgenommene Untersuchung des BAIRD' schen Originalexamplars ergab, dass diese Art mit dem Ph. varians KEFERSTEIN identisch ist! ". It is improbable that these authors examined any of the extant syntypes of *P. perlucens* since these specimens do not correspond to *P. varians*, but rather to *P. dentigerum* Selenka and de Man (see below). The occasion for the error remains unexplained.

Description : The largest of the three specimens, the one figured by Baird, measures 35 mm in length to the base of the introvert, which is almost entirely retracted, and 3·5 mm in maximum width. In the smallest specimen the trunk is 21 mm long with a maximum width of 1·5 mm and the introvert is partially extended to a length of 7 mm. The trunk of the third specimen is 25 mm in length, 2 mm in maximum width, and the partially extended introvert is 10 mm long. The trunk regions of all specimens are pale and whitish with a thin integument through which longitudinal muscle bundles are visible. The preanal regions and the base of the dorsal introvert are markedly darker due to a concentration of reddish brown, conical, sometimes sharply pointed papillae which become progressively smaller and lighter anteriorly. On the ventral introvert the papillae are generally less prominent. Some papillae on the posterior introvert are pointed in a posterior direction. On the anterior half of the trunk, posterior to the anus, the papillae are colourless, low, mostly oval in shape, and widely spaced. The papillae on the posterior half of the trunk are more conical and light brown in colour, increasing in height and density posteriorly and becoming sharply pointed at the posterior extremity. Platelets surrounding the central opening of the papillae are darker than peripheral platelets. Hooks from the anterior retracted introvert of the largest specimen measure 0·061 mm at the base and 0·065 mm in height (Figure 15). They are sharply bent terminally and show an accessory tooth. The clear triangular area is well-defined.

One of the specimens, intermediate in size, was dissected (by MER). The longitudinal muscle bands show little anastomosis and number 20–22 posterior to the origin of the ventral retractors. The spindle muscle attaches immediately anterior to the anus and is attached to the posterior extremity. There are approximately 16 single intestinal coils. A single fixing muscle originates to the left of the ventral nerve cord, anterior to the roots of the dorsal retractor muscle and gives off a branch to the postœsophageal intestine and one to the rectum. Two nephridia, opening at the level of the anus, extend posteriorly one-half the length of the trunk and attach to the body wall for three quarters of their length. A pair of black eye-spots is present on the brain. Sixteen rows of hooks were counted through the wall of the retracted introvert.

Remarks : *Phascolosoma perlucens* Baird 1868 corresponds to *Phascolosoma dentigerum* Selenka and de Man 1883. Similarities are apparent in the following taxonomic characters : form, distribution, and colouration of papillae, structure of hooks (Figure 15) and hook papillae (Figure 14), relative proportions of the body, and essential features of internal anatomy.

Phascolosoma placostegi Baird, 1868

Phascolosoma placostegi Baird, 1868, p. 89–90.

HOLOTYPE : Reg. No. 1965.25.11

TYPE LOCALITY : Cape of Good Hope. Coll. Krauss ; found lodged in a mass of Serpulidae (*Placostegus*).

The holotype, hardened and brittle, is in very poor condition and disintegrates when manipulated. None of the internal characters could be distinguished, nor any hooks recovered. The reason for the poor state of preservation is found in Baird's statement that the specimen when found " was dry, but afterwards moistened and put into spirits " (Baird, 1868, p. 90). Since Baird's description was limited to non-specific external characters, the species cannot be defined and the name *Phascolosoma placostegi* therefore must be considered as a nomen dubium.

Phascolosoma planispinosum Baird, 1868

Phascolosoma planispinosum Baird, 1868, p. 93.
Phymosoma nigrescens : Selenka, de Man, and Bülow, 1883, p. 73.

HOLOTYPE : Reg. No. 1965.25.6.

TYPE LOCALITY : Unknown. Coll. Cuming.

The holotype has been allowed to dry out completely at some time and is quite contracted and inflexible. It had been dissected previously and most of the internal organs are missing in part or entirely. Fortunately the specimen was seen by Selenka, de Man and Bülow (1883) who placed it in synonymy with *Phascolosoma nigrescens* Keferstein 1865 and considered it to be identical with a variety from the Philippine Islands which they described but to which they did not give a varietal name. Since Baird stated that he had only one specimen, this is undoubtedly the same specimen which Selenka examined.

In spite of the poor condition of the specimen, it was possible to recover some hooks, one of which is figured (Figure 20). This hook differs from those of specimens of *Phascolosoma nigrescens* from the Fiji Islands and Mauritius illustrated by Selenka (Selenka, de Man, and Bülow 1883, Figures 130, 135), in that the clear streak of *P. planispinosum* is quite distinct from the clear triangular area and an accessory tooth is lacking. There is, however, a thickening in the basal plate, similar to that characteristic of *P. nigrescens* (Fisher 1952). The triangular space was not as distinct in all of the hooks examined as in the one illustrated (Figure 20), but the form of the central clear streak appeared consistent. Selenka, de Man and Bülow did not illustrate hooks from the specimens of *P. nigrescens* from the Philippines with which they considered *P. planispinosum* identical.

Themiste lageniformis Baird, 1868

Themiste lageniformis Baird, 1868, pp. 98–99, pl. 10, figs. 3–3c.

SYNTYPES : 1965.25.9/10

TYPE LOCALITY : Australia?

The two specimens on which Baird based his original description of the species are in the same condition as he indicated at that time. In one specimen the introvert and tentacles are extended, but the animal is hard and brittle, apparently having been desiccated at some time after preservation. In the second specimen the introvert is completely retracted. The second specimen was dissected by one of the present authors (ACS).

Baird noted the resemblance of the shape of the extended body to a flask and from this character he derived the specific name, *lageniformis*, meaning flask-shaped. Other characters used by Baird to define the species were as follows : striations and folds of the skin approaching a clathrate pattern posteriorly ; a long, cylindrical introvert covered by a wrinkled, plicate skin ; six pinnate tentacles (the number 6 was followed by a question mark).

The following description includes information on the internal anatomy of one of the syntypes and is intended to supplement Baird's reported observations.

DESCRIPTION : The extended specimen, previously desiccated and grotesquely contracted in the mid-region of the trunk, measures approximately 22 mm in length to the base of the tentacles. The number of tentacles appears to be six, but the specimen was preserved in such a way that the oral disc was not visible and manipulation was precluded by the brittle condition ; hence, it was not possible to affirm whether these were six primary stems. Hooks do not occur on the introvert. The anal opening occurs along the narrowed anterior portion of the body, 8 mm from the base of the tentacles, and the introvert is approximately one-third to one quarter the length of the remainder of the body, an exact figure being difficult to ascertain because of the contracted region in the middle of the body.

In the other syntype, in which the anterior end is retracted, the length of the trunk from anus to posterior extremity is approximately 24 mm and the withdrawn introvert is about a quarter of this length. Longitudinal and transverse grooves in the skin form a tessellated pattern over most of the trunk. The pattern is most pronounced at the base of the introvert and posterior extremity where the grooves are deepest. In the middle of the body the longitudinal grooves are weak or non-existent and the transverse grooves shallow ; consequently, the tessellation is not so apparent The openings of the epidermal glands occur within the rectangles of the tessellation ; in the middle of the body where the skin is more distended they are most readily observed and appear as openings in the centre of concave depressions (Figure 13).

Internally the body wall musculature of the dissected syntype is smooth, two thick retractors originate in the posterior fifth of the trunk remaining separate for most of their length, and the gonad appears as a thin strand on the base of the retractors (Figure 12). The œsophagus is directed posteriorly to a point at the base of the ventral retractors where it is attached by a fixing muscle ; it then turns

abruptly anteriorly to enter the intestinal coil. The intestine is comprised of approximately 28 single coils and has no posterior attachment. Through the thin walls of the descending gut the contents can be seen to consist of fine sand or mud particles which have been compacted and twisted into a spiral form. A caecum is present at the beginning of the rectum. The spindle muscle, passing by and attaching to the base of the caecum, runs along the dorsal side of the rectum and appears to insert on it. There is no attachment of the spindle muscle to the posterior body wall. Prominent wing muscles fasten the rectum to the body wall in the region of the anus.

There are three fixing muscles. F_1 attaches the œsophagus to the body wall just posteriorly to the inner margin of the left retractor muscle. Broken from its site of origin on the body wall, F_2 is attached to the first descending intestinal coil. F_3, attached to the body wall near the dorsal midline in the anterior third of the body, proceeds beneath the intestinal coil to attach to the beginning of the rectum as it emerges from the intestinal coil.

A prominent contractile vessel is adjoined to the descending œsophagus but ends just beyond the point at which the œsophagus curves anteriorly toward the intestinal coil. Anteriorly the vessel is very much enlarged and distended with cellular elements, but more posteriorly it gives off numerous tufts of short filiform villi which frequently bifurcate near their basal attachments.

Two nephridia hang freely in the body cavity. The nephridiopores open at about the same level as the anus.

Remarks : These specimens correspond to Selenka's (1883) description and illustrations of *Dendrostoma signifer* in the characteristic arrangement and form of the contractile vessel and villi, the number and attachment of the fixing muscles, the relatively short introvert, and the furrowing of the skin. Although Selenka does not mention a caecum for *D. signifer*, other authors (Edmonds 1956, Ikeda 1904, Wesenberg-Lund 1959) have reported a rectal diverticulum for this species. The number of tentacular stems has been variously reported as 5 or 6 (Selenka 1883) or as 4 (Ikeda 1904, Edmonds 1956, Fischer 1919).

Although Selenka lists *Themiste lageniformis* in an appendix (Selenka, de Man, and Bülow, 1883, Appendix E), he makes no mention of the name elsewhere in the monograph. Presumably he had not examined Baird's syntypes when he described *Dendrostoma signifer* as a new species.

Aspidosiphon cumingii Baird, 1868

Aspidosiphon cumingii Baird, 1868, p. 102, pl. xi, fig. 2 ; Selenka, de Man and Bülow, 1883, p. 113–115.

Type locality : Philippine Islands. Coll. Cuming.

Baird's description was superficial, but the holotype was fully described by Selenka, de Man and Bülow and the name remains valid. The specimen is missing from the collection, possibly never returned to the British Museum (Natural History) by Selenka.

Aspidosiphon jukesii Baird, 1873

Aspidosiphon jukesii Baird, 1873, p. 97.

HOLOTYPE : Reg. No. 1965.25.3.

TYPE LOCALITY : Lee Sandbanks (Great Barrier Reef, Australia?).

Baird's brief description (Baird, 1873) enumerated a few general external features, but provided no significant characters by which this species could be distinguished by other authors. Hence the species was not recognized in the literature, even though the type remained extant in reasonably good condition in the collections of the British Museum (Natural History). The holotype was dissected by one of the present authors (ACS) and a report of its internal anatomy is presented here. The specimen had been removed at the time of its collection from a solitary coral, the remains of which are still preserved.

DESCRIPTION : Preserved in a curved, U-shaped position, the specimen measures 25 mm along the median line of the outer, dorsal curvature with a maximum width of approximately 5 mm (Figure 24). The introvert is entirely retracted. The integument of the posterior two-thirds of the trunk is thin, distended, and pale yellow, whereas the anterior one-third is more tightly contracted and a deeper yellow. A well-developed, dorsally oblique anal shield is clearly set off from the remainder of the body (Figure 21, 22). Approximately 12 major longitudinal furrows, not all complete, mark the flattened surface of the shield which is composed of large, irregularly shaped, amber-coloured platelets. Lateral and ventral extensions of the shield are distinguished by raised papillae, densely packed, with embedded amber platelets similar to those of the dorsal surface of the shield. A small clear spot marks the apex of each papilla. Over the remainder of the trunk the papillae are more widely dispersed, smaller, and flatter with a relatively large central area surrounded by one or more rings of pale yellow coalesced platelets which form clumps of varying sizes (Figures 28, 29). The papillae may reach a width of 0·7 mm in the posterior quarter of the trunk, but they are only slightly elevated from the surface with a maximum height of approximately 0·3 mm. The posterior shield is circular, well-demarcated, but lighter in color than the anal shield (Figure 23). There are a few weak, irregular radial striations which do not extend to the center of the shield. The constituent pale yellow platelets vary in size and are larger and darker in the central portion.

Small, pale hooks are arranged in rows on the anterior introvert. At their base the hooks measure about 0·028 mm and their height is 0·025 mm. The hooks are weakly curved with a secondary terminal point and a large central clear area which is widened proximally to include the entire base (Figure 25). Introvert papillae, measuring about 0·013 mm in height and 0·008 mm in diameter, are dispersed among the rows of hooks (Figure 27). Larger spines with a height of 0·035 mm are scattered more posteriorly over the introvert. Because of its retracted condition, the entire introvert was not examined.

The musculature of the body wall is smooth. Two retractors attach at the posterior extremity in the region of the terminal shield. Separated posteriorly, they soon join and are united for about two-thirds of their total length. At the point of union

of the retractors the œsophagus bends in an anterior direction to join the intestinal coil. Numerous coils (approximately 30 single coils) comprise the intestinal spiral, but an accurate count is not possible because of the poor state of preservation of the gut. A spindle muscle attaches the intestine posteriorly. The anal opening is immediately posterior to the flattened anterior shield and the two nephridia open at nearly the same level. The nephridia are partially attached to the body wall, but unfortunately the free ends have been broken off so that neither the length of the nephridia nor the relative extent of their attached portion can be determined.

REMARKS : This specimen resembles *Aspidosiphon corallicola* Sluiter, 1902, both in its habitat in a solitary coral and in the following taxonomic characters : origin and union of the two retractor muscles, morphology of anterior and posterior shields, and the structure and distribution of the hooks, spines, and papillae.

Although similar in basic structure, the hooks and spines differ in size for the holotype of *Aspidosiphon jukesii* and *A. corallicola*. The height of the hooks is the same in both (0·025 mm), but the width in *A. corallicola* is proportionately greater. Moreover, Sluiter (1902) reported that in *A. corallicola* the spines were smaller than the hooks, whereas the reverse is true for the holotype of *A. jukesii*. Without additional measurements to indicate the range of variation within and among individuals the significance of the size discrepancies is difficult to evaluate. However, the other important similarities between *A. jukesii* and *A. corallicola* suggest that the two names represent a single species. *A. jukesii* has priority, since it is the older name.

Pseudasipidosiphon gracile Baird, 1868

Pseudasipidosiphon gracile Baird, 1868, p. 103, pl. x, fig. 1, 1a.
Aspidosiphon gracilis : Selenka, de Man and Bülow, 1883, p. 122–123, pl. ii, fig. 22, pl. xiv, fig. 209–213.

SYNTYPES : Reg. No. 43.5.15.58a/b.

TYPE LOCALITY : Philippine Islands. Coll. Cuming.

Baird seems to have had three specimens, one of which was examined and described by Selenka. Since neither of the two specimens in the collection has been previously dissected, it is probable that Selenka did not return the specimen which he described. Selenka gave a complete, well-illustrated description of Baird's specimen, so that the specific name remains valid.

Echiurus farcimen Baird, 1873

Echiurus farcimen Baird, 1873, p. 97.
Echiurus chilensis : Shipley, 1899, p. 342.

HOLOTYPE : Reg. No. 69.6.28.18.

TYPE LOCALITY : Punta Arenas, Patagonia. Coll. Cunningham.

In Baird's brief description of the species, he mentioned 5 specimens, the largest of which was 16 inches in length. Only one of these specimens remains in the collection and, although previously dissected, it is still in good condition. Its approximate measurements are 170 mm in length and 125 mm in maximum circumference. With

rounded extremities and considerably reduced prostomium, the specimen resembles a sausage in shape. One of the members of the anteroventral pair of setae is missing, but the intact seta, slightly curved, is extended to a length of 4 mm. A single ring of 12 smaller setae, marked by a mid-ventral gap, encircles the posterior extremity. There are three pairs of prominent nephridia, each with two long, spirally coiled lips. Two anal vesicles reach lengths approximately one-half that of the body.

Shipley (1899) considered Baird's specimens of *Echiurus farcimen* to be synonymous with *E. chilensis* Max Müller 1852 and later authors (Fisher 1946, Wesenberg-Lund 1955, Amor 1965) have accepted this synonymy. Since 1907, when Seitz revised the genus, this species has been known as *Urechis chilensis*.[1]

Table I

1. Gray and Baird species-names which are senior subjective synonyms of currently accepted names.

Senior synonym	Current name
Siphunculus arcuatus Gray, 1828	*Phascolosoma lurco* (Selenka & de Man, 1883)
Phascolosoma perlucens Baird, 1868	*Phascolosoma dentigerum* (Selenka & de Man, 1883)
Themiste lageniformis Baird, 1868	*Themiste signifer* (Selenka & de Man, 1883)
Aspidosiphon jukesii Baird, 1873	*Aspidosiphon corallicola* Sluiter, 1902

2. Gray and Baird species-names which are currently accepted.

Themiste hennahi Gray, 1828
Sipunculus angasi Baird, 1868
Phascolosoma albolineatum Baird, 1868
Aspidosiphon cumingi Baird, 1868
Aspidosiphon gracile (Baird, 1868)

3. Gray and Baird species-names which are junior subjective synonyms of currently accepted names.

Junior synonym	Current name
Siphunculus dentalii Gray, 1828	*Phascolion strombi* (Montagu, 1804)
Siphunculus tuberculatus Gray, 1828	*Phascolosoma noduliferum* Stimpson, 1855
Sipunculus aeneus Baird, 1868	*Siphonosoma australe* (Keferstein, 1865)
Sipunculus deformis Baird, 1868	*Siphonosoma cumanense* (Keferstein, 1866)
Sipunculus eximioclathratus Baird, 1868	*Sipunculus nudus* Linnaeus, 1766
Phascolosoma aethiops Baird, 1868	*Phascolosoma antillarum* Grube & Oested, 1859

1. Seitz (1907) erected the genus *Urechis* for the species *Echiurus chilensis* Max Müller and *E. unicinctus* von Drasch. Riveras Zuñiga (1942), on grounds of priority, revived the generic name *Pinuca* Hupé in Gay 1854, but more recently Jones, Hedgpeth, and Hand (1968) have applied to the International Commission on Zoological Nomenclature for the suppression of *Pinuca*. At this date no action has been taken on this request.

Junior synonym	Current name
Phascolosoma capsiforme Baird, 1868	*Golfingia margaritacea* (Sars, 1851)
Phascolosoma fasciatum Baird, 1868	*Phascolosoma granulatum* (F. S. Leuckart, 1828)
Phascolosoma grayi Baird, 1868 (nom. nov. pro. *Siphunculus tuberculatus* Gray, 1828)	*Phascolosoma noduliferum* Stimpson, 1855
Phascolosoma jeffreysii Baird, 1868	*Phascolosoma granulatum* (F. S. Leuckart, 1828)
Phascolosoma lordi Baird, 1868	*Phascolosoma agassizii* Keferstein, 1866
Phascolosoma nigriceps Baird, 1868	*Phascolosoma antillarum* Grube & Oersted, 1859
Phascolosoma planispinosum Baird, 1868	*Phascolosoma nigrescens* Keferstein, 1865
Echiurus farcimen Baird, 1868	*Urechis chilensis* Max Müller, 1852

4. Baird name which is a nomen dubium.
Phascolosoma placostegi Baird, 1868.

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PLATE 1

Siphunculus arcuatus Gray. Holotype.
Current Name : *Phascolosoma arcuatum* (Gray)

FIG. 1. Dissected specimen showing internal anatomy. In the preserved specimen the retracted introvert is coiled within the body cavity ; for clarity in the drawing it is straightened and the intestinal coil is pulled aside to reveal other internal structures. AR, anterior retractor ; E, œsophagus ; G, gonad ; I, retracted introvert ; N, nephridium ; NC, ventral nerve cord ; PR, posterior retractor ; R, rectum ; S, spindle muscle ; W, wing muscle. Approximate length of specimen is 100 mm.

FIG. 2. Papilla from middle region of trunk. Note polygonal platelets, smaller and more concentrated around centre, but otherwise evenly distributed. Diameter 0·3 mm.

FIG. 3. Lateral view of holotype, showing external features. Introvert is retracted. A, anus ; NP, nephridiopore. Rectangles a, b, and c, each measuring 1 × 4 mm on specimen, are enlarged at left to show relative size, form and distribution of papillae. 3a. Enlargement of skin area at base of introvert. 3b. Enlargement of skin area from middle region of trunk. 3c. Enlargement of skin area from posterior extremity.

FIG. 4. Diagrammatic representation of body wall from middle third of trunk, showing the coelomic sacs and their relation to the musculature of the body wall and overlying integument. The integument, shown only in the lower right portion of the diagram, is markedly thinner in the areas covering the sacs. CM, circular muscle bundle ; CS, coelomic sac ; IN, integument ; LM, longitudinal muscle bundle ; P, papilla.

FIG. 5. Hook from introvert. 0·08 × 0·07 mm.

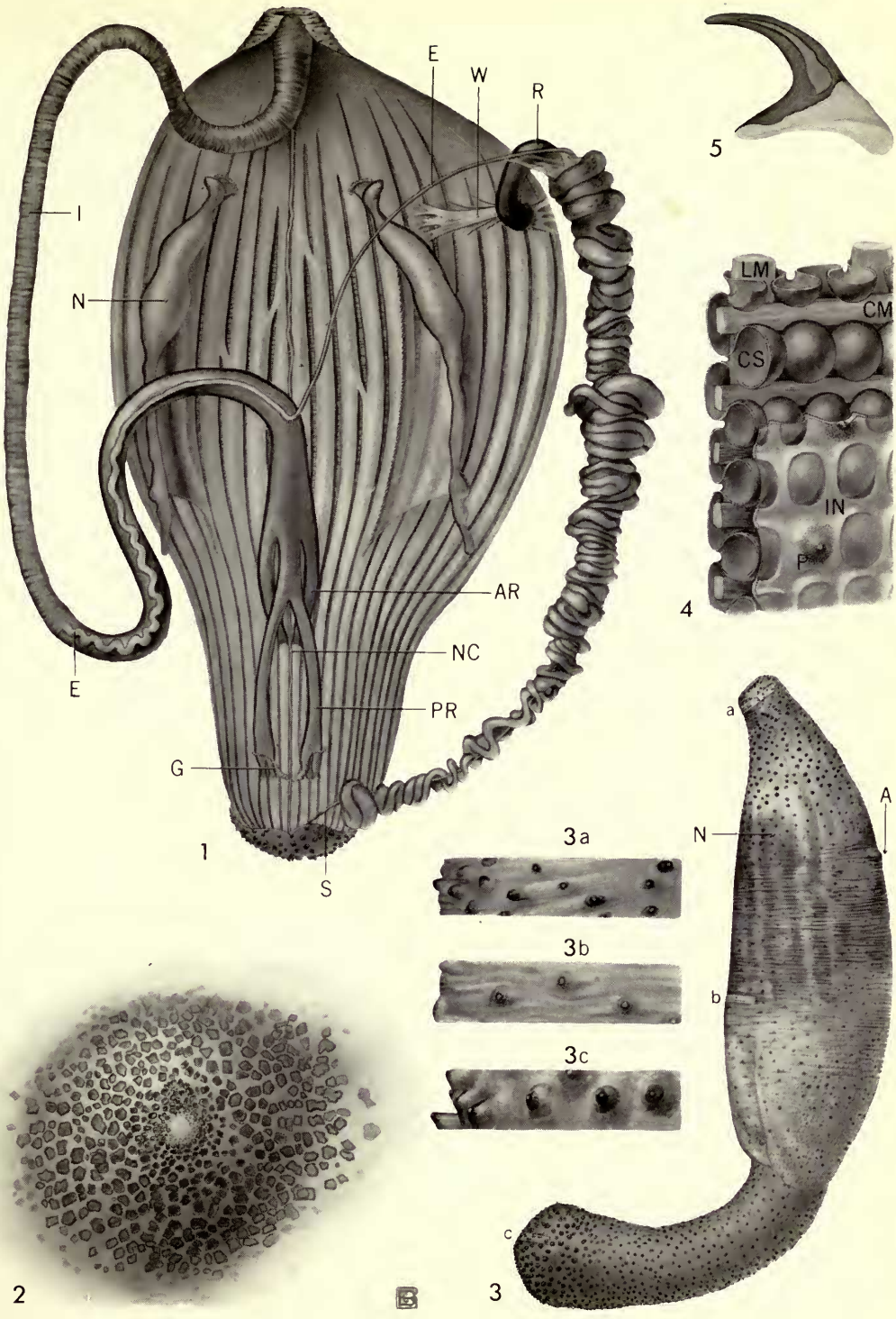
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PLATE 2

FIG. 6. *Themiste hennahi* Gray. Paralectotype, dissected specimen. A, anus ; C, caecum ; CV, villi of contractile vessel ; E, œsophagus (looped under right retractor) ; F1, fixing muscle 1 ; F2, fixing muscle 2 (broken) ; F3, fixing muscle 3 ; N, nephridium ; NC, nerve cord ; RM, retractor muscle ; S, spindle muscle. Approximate length of trunk is 37 mm.

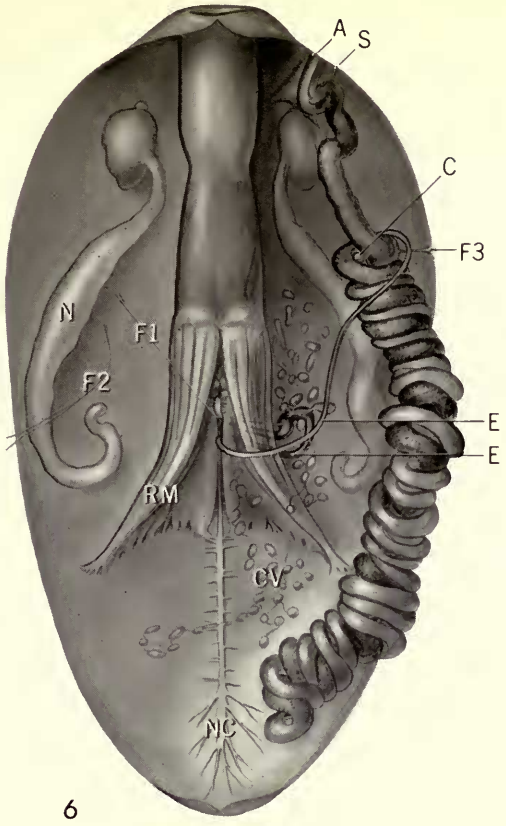
FIG. 7. *Themiste hennahi* Gray. Lectotype. Oral view of tentacular crown, oriented with dorsal tentacles toward bottom of page. The 6 lips surrounding the mouth are evident between the bases of the tentacles.

FIG. 8. *Themiste hennahi* Gray. Lectotype. Lateral view showing external features. A, anus ; NP, nephridiopore. Approximate length of body (minus tentacles) is 70 mm. Squares a, b, c, d, each 1 mm^2 on specimen, are enlarged on right to show details of skin and papillae. 8a, Introvert. Cuticle has been detached exposing canals of epidermal papillae. 8b, Enlargement of integument in anal region. 8c, Enlargement of integument in middle of trunk. 8d, Enlargement of integument in posterior extremity of trunk.

FIG. 9. *Siphunculus tuberculatus* Gray. Holotype. Current name : *Phascolosoma noduliferum* Stimpson. Hook from introvert. 0·058 mm × 0·047 mm.

FIG. 10. *Siphunculus tuberculatus* Gray. Holotype. Papilla from base of introvert. Diameter, 0·27 mm. Darkly pigmented platelets are arranged in a distinctive ring around the clear central area.

FIG. 11. *Siphunculus tuberculatus* Gray. Holotype. Posterior 1/10 of trunk, showing dense concentration of prominent, dome-shaped papillae.



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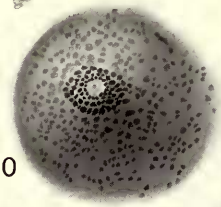

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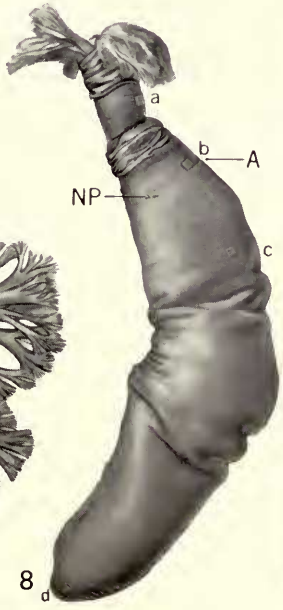

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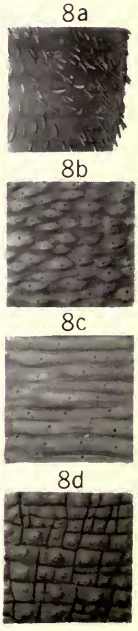


PLATE 3

FIG. 12. *Themiste lageniformis* Baird. Syntype. Dissected specimen. In the specimen the incision had been made through the outer edge of the base of the left retractor muscle, but for purposes of clarity and orientation in the drawing the line of incision and the muscle are reconstructed so that the muscle appears intact. C, caecum ; CV, contractile vessel ; E, œsophagus ; F1, fixing muscle 1 ; F2, fixing muscle 2 (broken) ; F3, fixing muscle 3 ; G, gonad ; N, nephridium ; NC, nerve cord ; R, rectum ; RM, retractor muscle. Approximate length of trunk is 24 mm.

FIG. 13. *Themiste lageniformis* Baird. Syntype. Enlargement of skin (1 mm^2) from posterior area of trunk showing horizontal grooves and less distinct vertical grooves surrounding openings of epidermal glands.

FIG. 14. *Phascolosoma perlucens* Baird. Syntype. Apical view of small papilla from introvert, located among rows of hooks on anterior introvert.

FIG. 15. *Phascolosoma perlucens* Baird. Syntype. Hook from anterior introvert. 0·061 × 0·065 mm.

FIG. 16. *Phascolosoma fasciatum* Baird. Syntype. Current name : *P. granulatum* (Leuckart). Lateral view of small papilla from introvert ; situated among rows of hooks on anterior introvert.

FIG. 17. *Phascolosoma fasciatum* Baird. Syntype. Current name : *P. granulatum* (Leuckart). Hook from introvert. 0·072 mm (base) × 0·074 mm (height).

FIG. 18. *Phascolosoma lordi* Baird. Holotype. Current Name : *P. agassizii* Keferstein. Hook from introvert. 0·057 × 0·068 mm.

FIG. 19. *Phascolosoma jeffreysii* Baird. Holotype. Current name : *P. granulatum* (Leuckart). Hook from introvert. 0·057 × 0·049 mm.

FIG. 20. *Phascolosoma planispinosum* Baird. Holotype. Current Name : *P. nigrescens* Keferstein. Hook from introvert. 0·053 × 0.041 mm.

FIG. 21. *Aspidosiphon jukesii* Baird. Holotype. Laterodorsal view of anterior shield. A, anus.

FIG. 22. *Aspidosiphon jukesii* Baird. Holotype. Lateral view of anterior shield. A, anus.

FIG. 23. *Aspidosiphon jukesii* Baird. Holotype. Apical view of posterior shield.

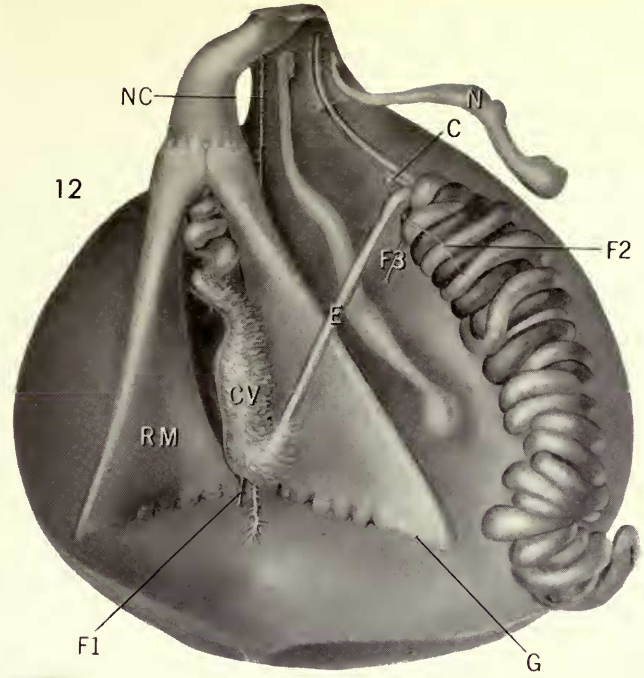
FIG. 24. *Apsidosiphon jukesii* Baird. Holotype. Lateral view of entire animal. Specimen is approximately 25 mm in length, measured along median dorsal curvature.

FIG. 25. *Aspidosiphon jukesii* Baird. Holotype. Hook from anterior introvert. 0·028 (base) × 0·025 mm (height).

FIG. 26. *Aspidosiphon jukesii* Baird. Holotype. Spine from posterior introvert. 0·035 mm (height).

FIG. 27. *Aspidosiphon jukesii* Baird. Holotype. Lateral view of small papilla from introvert ; situated among rows of hooks on anterior introvert.

FIGS. 28, 29. *Aspidosiphon jukesii* Baird. Papillae from the middle region of the trunk showing coalescence of platelets. 28. 0·54 mm, diameter. 29. 0·81 × 0·54 mm.



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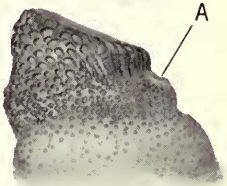

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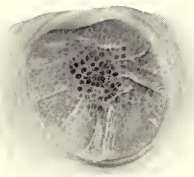

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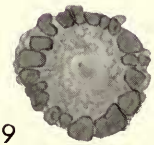

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